teacher of any other branch ; and restriction of subjects rather than their enlargement is the need.

It is impossible to discuss the subject of the future of philosophy-teaching in this country without reference to the mooted question of 'electives.' It is evident that the great majority of those American colleges that have not introduced the elective system are giving all the time to philosophic studies possible, though I do not undertake to say whether or not that time be distributed in the wisest way. In fact, the outside scoffer would probably say that relatively too much time is given them, when all studies are required. It will be noticed that the colleges where least philosophy is required are the ones where most is taught, and the ground is most widely covered. Personally, I should not be surprised to know that they are the ones where most vital interest is taken in these studies, save in the instances, happily many, of the smaller colleges, where the philosophic teaching is in the hands of a man of such strong character that the teaching is a lasting power for life in an ethical way, whatever may be said of the strictly technical value of the philosophy taught. JOHN DEWEY.

INSECTIVOROUS PLANTS.

THE peculiar insect-capturing habits of certain of our native plants were observed nearly a century ago, and the belief was then entertained that the peculiar phenomena served some direct object in the plants' economy ; in other words, that the captured insects served as nutritive material. These observations, however, were long forgotten, or received but little attention, till, in 1875, Darwin's well-known work on insectivorous plants appeared. Since then a very great impetus has been received by botanists in their study, that has resulted in large additions to the literature of the subject. In a recent paper by the well-known botanist of Jena, Prof. W. Detmers (*Nord und süd*, 1886, 72, 81), a review of our present knowledge is given, from which the following is obtained.

At present it is well known that the function of the green tissue is the absorption of carbonic acid from the surrounding medium under the influence of light, and its decomposition and formation therefrom of organic compounds. Most of the higher plants are capable of complete and perfect development solely by the aid of purely inorganic materials, though in the larger number organic matter may and does form a share of the nutritive material. In the economy of nature this function is a most important one, as plants thus occupy an intermediate position between the animal and inorganic kingdoms.

But some plants are not thus provided with the green or chlorophyl tissue, and are dependent more or less upon organic foods. In some, as the mildews, the power of transforming inorganic to organic substances is wholly wanting ; while in others, as, for instance, certain orchids, such as Neottia nidus avus, the power is much restricted. Likewise the mistletoe, though sufficiently rich in chlorophyl, derives much of its material from the sap of trees upon which it is parasitic. Insectivorous plants, in the same way, seem to occupy an intermediate position between those dependent entirely upon inorganic and those which derive their material purely from organic sources.

The term 'insectivorous,' as applied to plants, is, however, not strictly correct, nor would 'carnivorous' be much better. Different forms of animal life are captured by such plants as have received this appellation, and by the aid of secreted juices are digested and absorbed ; but there is no mechanical action except in capturing and holding the objects, and therefore 'flesh-digesting' would express more correctly the process.

One of the best known of insectivorous plants is the 'sundew' plant (Drosera), species of which are distributed over nearly the whole world. It is small and low, growing about meadowy places, and conspicuous for the sparkling drops of fluid substance that are seen upon its leaves. The leaves, which are about four millimetres in diameter, have upon their upper surface a large number of peculiar tentacle-like organs, as many as two hundred in some cases. The ones in the middle are shorter and upright ; those near the sides, longer and more horizontal. Each tentacle consists of a stem, permeated by a spiral tube, and a glandular head, which emits a drop of colorless, sticky, and stringy fluid. This substance apparently serves to attract insects as well as to retain them when once they have alighted upon the leaf, as it is seldom that they are able to extricate themselves after coming in contact with it. To yet further assure this retention, the leaves possess the power of closing or folding together, brought about slowly by the irritation conveyed through the tentacles. An insect thus firmly enclosed remains till the fluids secreted by the tentacular glands have caused its solution, or, more properly, digestion. Any foreign object, be it mineral or animal, will cause the closure of the leaf and the secretion of fluids ; but there is this remarkable difference, — a mineral substance only produces the flow of an acid secretion, while an insect or piece of flesh causes, in addition, a

secretion of pepsin. The process is almost precisely like that which occurs in the animal stomach, — a secretion of acids and ferment produced by the contact of digestible substances. The ferment or pepsin is not, however, a peculiarity of such plants alone. The milky sap of many others contains the same substance, and almost generally throughout the vegetable kingdom a ferment is produced in seeds during germination, rendering the reserve material, upon which the young plant is dependent, assimilable.

Yet better known is another plant of the same family (Droseraceae), the venus fly-trap (Dionaea), that grows in the wet lands of North Carolina. The leaves, about six centimetres in length, springing from the ground, have an elongated, winged stalk, bearing an orbicular leaf at its extremity, which is capable of sudden folding or closure. Along the margin of each leaf are a number of long, immovable, bristly hairs; and near the middle of each side, on the upper surface, three slender irritable hairs, which have the peculiar power, when touched, of conveying the irritation to the leaf-tissue, and causing immediate closure, the marginal bristles crossing each other, and preventing any possibility of escape. In addition to these hairs, there are a large number of glandular bodies attached by a short stem, which not only secrete the digestive fluids, but also serve as absorptive organs for the digested material. An insect or any digestible substance caught by this singular contrivance remains enclosed a relatively long time, while an inorganic or non-digestible object is much sooner released.

In a very different way the leaves of species of the pitcher-plant (Nepenthes) serve to entrap insects. Here the long leaf is prolonged into a tendril, which bears at its apex a tubular or oblong pitcher, sometimes a foot or more in length, closed with a hinged lid. About its rim there are a number of nectar-secreting glands, by which insects, and especially ants, are attracted. Entering easily into the upper part of the tube, they fall from the smooth surface to the bottom. Here there is a very large number of secreting glands, which, singularly, only in consequence of the irritation produced by the insects, pour out a considerable quantity of digestive fluid. This secretion shows, in the presence of albumen and flesh, a strong acid reaction, which, together with the associated pepsin, acts energetically upon animal substances, digesting them in a short time.

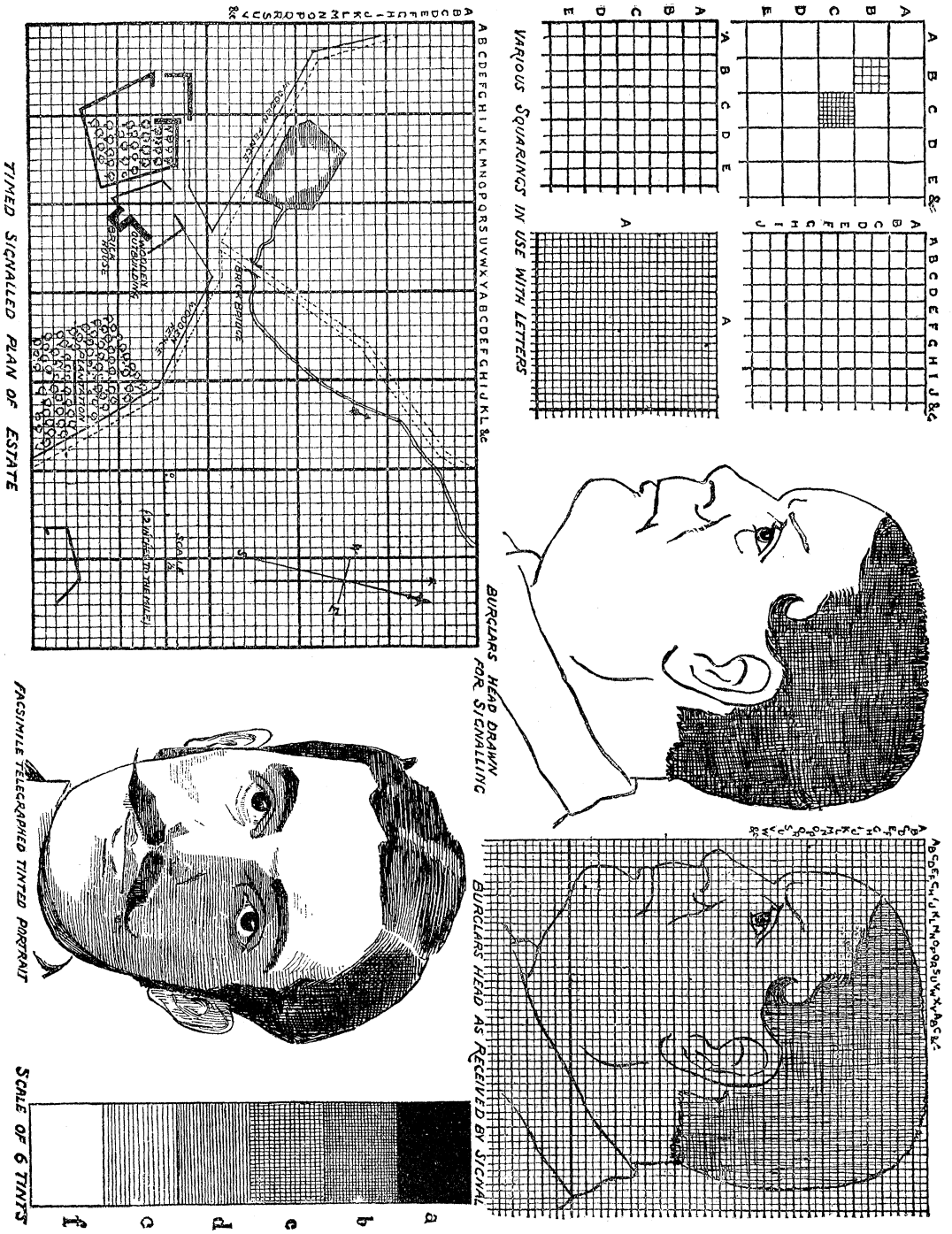
Again, species of our native Saracenia have the ascending hollow leaves so enclosed by a lid as to prevent the entrance of rain-water, but, by the nectar glands, attract and entrap insects, which are digested by the abundant secretion at the bottom. In addition to these, the aquatic bladderworts, or Utricularia of Europe and North America, although secreting no digestive fluid, may properly be classed among the insectivorous plants. The small bladders are so closed by a valve as to admit the ingress of insects, crustaceans, or newly hatched fish, but prevent their egress; and, from the large number that they are frequently found to contain, it is very probable that the ensuing decomposition is of direct advantage to the plant in furnishing nutritive, absorbable compounds.

The question, finally, whether organic material obtained and dissolved by the plant in the ways briefly described is indispensable or serviceable as nutrition, is important. Various carnivorous plants have been cultivated, secluded for a long time from all contact with organic material, without apparent deterioration in their development, so that it may at once be determined that such matter is not indispensable. However, in experiments with plants of Drosera rotundifolia, all kept under precisely the same circumstances, except that some were deprived entirely of organic food-material, while others received insects from time to time, it was found that the latter throve much better, and fructified much more abundantly.

These views, that the substances are of direct benefit to the plant, are, however, contested by Dr. Behr in a late number of the *Pharmaceutische rundschau*, who claims that it is not proved that the dissolved material is taken up as nutritive material, and so made use of. Its presence within the cells, or in the tissue of the plants, may be explained by simple capillarity, which is further evidenced by the absorption of inorganic substances, such as arsenious acid, by means of the secretions, as has been recently shown by Jaeger.

This opinion Dr. Behr supports by observations on species of Nepenthes, where he found that the pitchers, after the reception and solution of insects, were in no wise strengthened, but became injured and withered; and in cases of Drosera sulfurea and rosulata, where he likewise found that the leaves which had captured an insect always withered, and where many leaves were thus robbed of their true function, the plant weakened and died. He mentions the singular fact that the larvae of certain insects (Xanthoptera semicocca) are known to live in the exudations of Saracenia variolaris without being affected by the digestive fluids, — habits very similar to the known ones of bot-flies in the animal stomach.

It is very difficult indeed to understand how such remarkable contrivances, in connection with true digestive fluids, can exist, save on the theory that their function is a real one, and that they



subserve some direct use in plant-economy, and are not, as Dr. Behr would affirm, acquired peculiarities directly injurious to the organism.

A METHOD OF SIGNALLING DIAGRAMS.

AN ingenious system of adapting the alphabetical messages of the electric telegraph, or of the